DETAILED ACTION

1. The preliminary amendment of 06/24/05 is acknowledged, considered and entered.

Drawings

2. The drawings filed on 06/24/05 are accepted by the Examiner.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 15-45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Erie et al. (US Patent 6,330,824) in view of Quate (US Patent 5,633,455).

Regarding claims 15-16, 20 and 42-45, Erie discloses a method for measuring vibration frequency of a multi-cantilever (220) in which a plurality of cantilevers (D, E, F, col. 8, lines 21-22) are implanted towards an inner side of a base (290) (one of the ordinary skill in the art would have known to provide a spiral base if needed or required or as a matter of design choice) and having different natural frequencies (col. 8, lines 28-30) are illuminated with a common laser excitation spot (210, col. 2, lines 56-60) so as to simultaneously excite natural vibrations (col. 9, lines 23-27) of the plurality of cantilevers (Col. 2, line 53, col. 8, lines 21-22) by constant light excitation (210) to measure the vibrations (col. 7, lines 3-6). See also, col. 5, lines 56-65, col. 6, lines 63 to col. 7, line 6). Regarding claims 16 and 20, Erie discloses detection laser (col. 7, line

5 and col. 9, lines 19-21) to meet the limitations of Doppler meter and homodyne interferometer to perform the optical detection of the vibration. Although Erie discloses monitoring amplitude of the vibration, it does not particularly disclose or suggest measuring vibration frequency of the multi cantilever. Quate discloses because a plurality of cantilevers are provided and all of them are scanned simultaneously (col. 1, lines 56-57) the neutral position for each cantilever in an array of cantilevers as shown in FIG. 1 may be determined by applying a high-frequency signal to each of the counter electrodes, and detecting the mechanical resonant frequency of each cantilever by means of the piezoresistor (col. 5, lines 28-32). Quate further discloses other techniques may e used to detect the deflection of the cantilevers, including the laser beam (col. 8, lines 29-32). It would have been obvious to one having ordinary skill in the art at the time of the invention to utilize in Erie the techniques of Quate because the cantilevers are positioned near to the surface to be examined such that their tips are separated from the surface and since the mechanical resonant frequency of each cantilever will vary depending on the actual distance of its tip from the surface and the vibrational frequencies of the cantilevers can be detected. In addition, since the cantilevers typically have slightly different resonant frequencies, a base level resonant frequency for each cantilever is determined initially by vibrating it at a position removed from the substrate thereby, making the above combination more effective.

Regarding claims 24, 27, 30, 33, 36 and 39 they are similar in scope with claims 15-16 and 20, Therefore, they are rejected for the reasons set forth for these claims. Furthermore, Erie discloses control laser spot position (320) and frequency scanning

(col. 9, lines 21-27) in accordance with frequency gradients of the plurality of cantilevers (D, E, F) so that a material is detected with the cantilevers (col. 7, lines 6-10). In addition, the excitation of different cantilevers is successively excited in Erie since the cantilevers have different natural frequencies and the island shaped base would be a matter of design choice to one of the ordinary skill in the art.

Regarding claims 17 and 21, although Erie discloses a plurality of cantilevers, it does not particularly disclose the cantilevers are disposed radially in a cluster. Quate discloses the cantilevers may for example, be formed in rows and separated by selected distances (see abstract). Quate further discloses for example, the cantilevers may be arranged in some preselected pattern other than a row or a line (col. 8, lines 23-25). It would have been obvious to one having ordinary skill in the art at the time of the invention to utilize in Erie the techniques of Quate because the cantilevers are formed in the individual dice of a wafer which is the same size as the wafer to be examined and within each die, the cantilevers are formed in a single row wherein the longitudinal axes of the cantilevers are parallel and are separated by a uniform distance from each other thereby allowing and permitting the cantilevers to be excited simultaneously in a reliable manner.

Regarding claims 18-19 and 22-23, Erie does not particularly disclose or suggest a multi-cantilever according to claim 16 for self exciting the natural frequencies of the cantilevers to detect an interaction between a specimen and a probe at an end of each cantilever as a change in a self-excitation vibration frequency, a self-excitation vibration amplitude, or a self-excitation vibration phase and a mass/material detector using the

device for measuring vibration frequency of a multi-cantilever according to claim 16 for self exciting the natural frequencies of the cantilevers to detect a change in a mass adhered to a probe at an end of each cantilever as a change in a self-excitation vibration frequency, a self-excitation vibration amplitude, or a self-excitation vibration phase. Quate discloses the cantilevers are positioned near to the surface to be examined such that their tips are separated from the surface by approximately 10-200 .ANG. Since the mechanical resonant frequency of each cantilever will vary depending on the actual distance of its tip from the surface (because of the gradient of the van der Waals forces between the tip and surface), the vibrational frequencies of the cantilevers can be detected and this information will be indicative of the distance between the respective tips and the surface. Quate further discloses an appropriate DC voltage is then applied to each counter electrode to adjust the spacing between the corresponding cantilever and the surface (col. 5, lines 28-48). It would have been obvious to one having ordinary skill in the art at the time of the invention to utilize in Erie the techniques of Quate because each of the cantilevers is attached to a substrate at its fixed end and has the tip located near its free end and the cantilevers are positioned within a selected distance of each other wherein a voltage is applied to the terminals of the piezoresistor, and detection circuitry (e.g., a Wheatstone bridge) detects changes in the resistance of the piezoresistor as the cantilever deflects whereby particles are detected by monitoring the deflection of each cantilever, which is capable of detecting a particle by itself to make the above combination more reliable and effective.

Regarding claims 25, 28, 31, 34, 37 and 40, Erie in view of Quate discloses a modulation optical excitation (the vibration of the cantilever may be generated by focusing a modulated diode laser (heating laser 210), such as, for example, a modulated/variable-power visible-laser module onto the cantilever 220 using a single lens that produces a spot, see: col. 2, lines 56-58 of Erie).

Regarding claims 26, 29, 32, 35, 38 and 41, Erie discloses AC drive signal may be applied to the diode laser. As an example, the drive signal typically powers the piezoelectric transducer (FIG. 1) (see: col. 2, line 66 to col. 3, lines 2 of Erie).

Conclusion

5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to J M. SAINT SURIN whose telephone number is (571)272-2206. The examiner can normally be reached on Mondays to Fridays between 9:30 A.M and 6:00 P.M..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Hezron L. Williams can be reached on (571) 272-2208. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Jacques M SAINT SURIN/
Examiner, Art Unit 2856
June 20, 2008